Mushrooms

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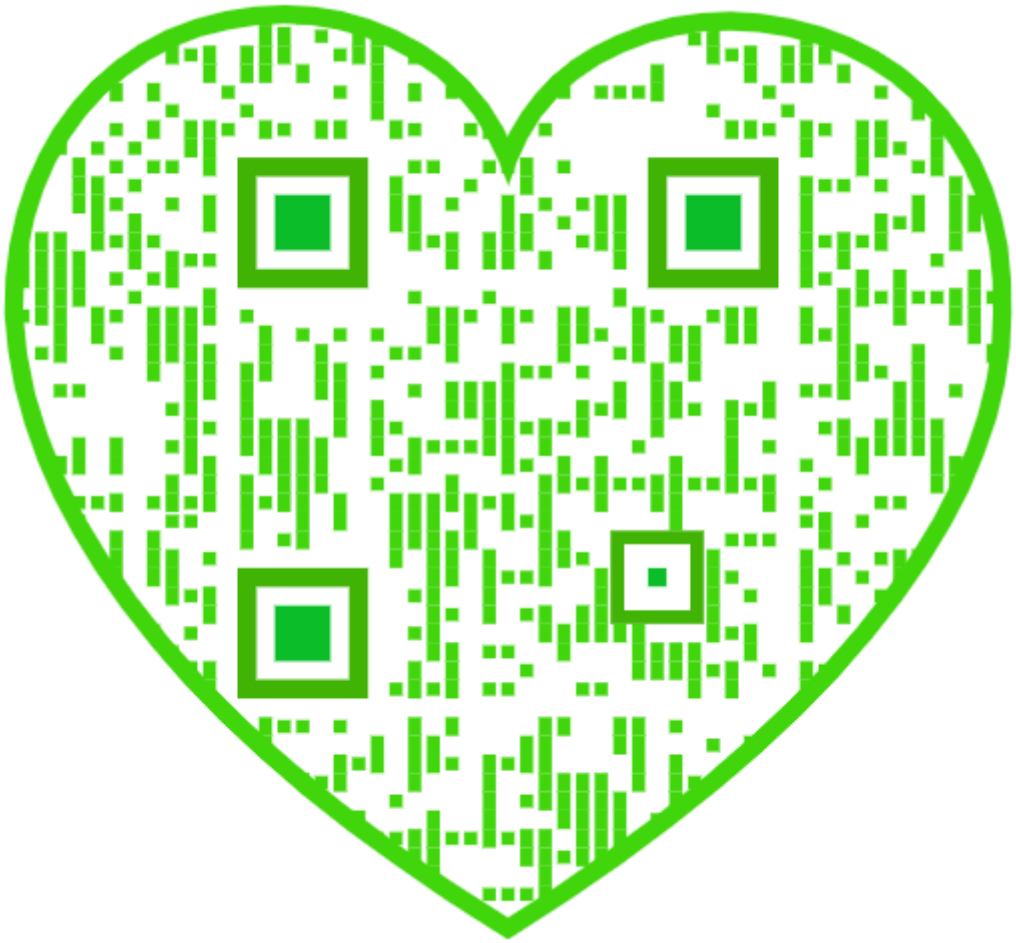

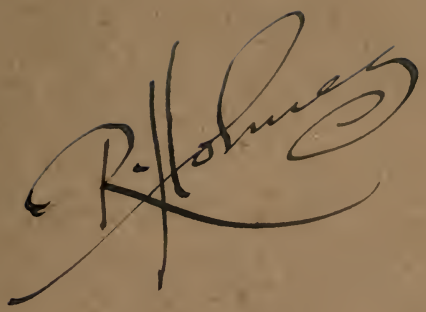

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COMMON MUSHROOMS OF THE UNITED STATES

By Louis C. C. Krieger

Continuing its policy of presenting to its readers comprehensive and especially timely articles and illustrations in color which stimulate a keener interest in and a more satisfying enjoyment of the glories and wonders of Nature's forests, plains, and hills, the National Geographic Magazine *publishes the accompanying series of matchless mushroom paintings and intimate descriptions by L. C. C. Krieger, who is associated with Dr. Howard A. Kelly, of Baltimore.*

The delicacy of coloring and variety of hues, the curious forms and astounding fertility of mushrooms, will amaze the reader. It is believed that Geographic members will take the same delight in their "Mushrooms" Number that they have expressed previously in such Nature-study numbers as "Birds of Town and Country," "American Game Birds," "Mankind's Best Friend—The Dog," "Our State Flowers," "Wild Animals of North America," etcetera.

The reader is especially cautioned, however, that the illustrations and text must not *be used as final authority in deciding whether a particular specimen is an edible or a poisonous fungus, because no treatise within the limits of a single number of even* The Geographic *could be sufficiently detailed and complete to protect the novice against the deadly species, which are very numerous. For those who desire more detailed description of mushrooms, this article is being amplified with much technical data and can be obtained separately, bound in cloth, at $3.00 per copy, postpaid.*

MORE than thirty-eight million pounds of edible mushrooms were imported into our country during the five years immediately preceding the World War. In addition to this vast amount, we consumed not only the large output of our own growers, but quantities of wild species besides.

The species imported from France comprise the cultivated variety of the common meadow or pasture mushroom, *Agaricus campester* (for illustrations see Plate I and page 400); the expensive truffle; the cèpe (*B. edulis*, illustrated in Plate IV and on page 406).

China sends us certain species largely for the use of her own people resident among us. Our own producers limit themselves to the cultivated variety of the meadow mushroom.

The names of the wild species marketed cannot be ascertained definitely, since there is with us no such legal control of the sale of mushrooms as obtains in most cities in continental Europe. Gatherers in the United States either eat their finds themselves or sell them promiscuously to any mushroom-hungry individual who has the temerity or the knowledge to venture purchasing.

Photograph by A. G. and B. Leeper

ONE OF THE POISONOUS MEMBERS OF THE AMANITA MUSHROOM FAMILY

The top view of the specimen on the right shows that the deadly Amanitas peel as readily as the edible mushrooms. "Peeling" is, therefore, no sign of edibility.

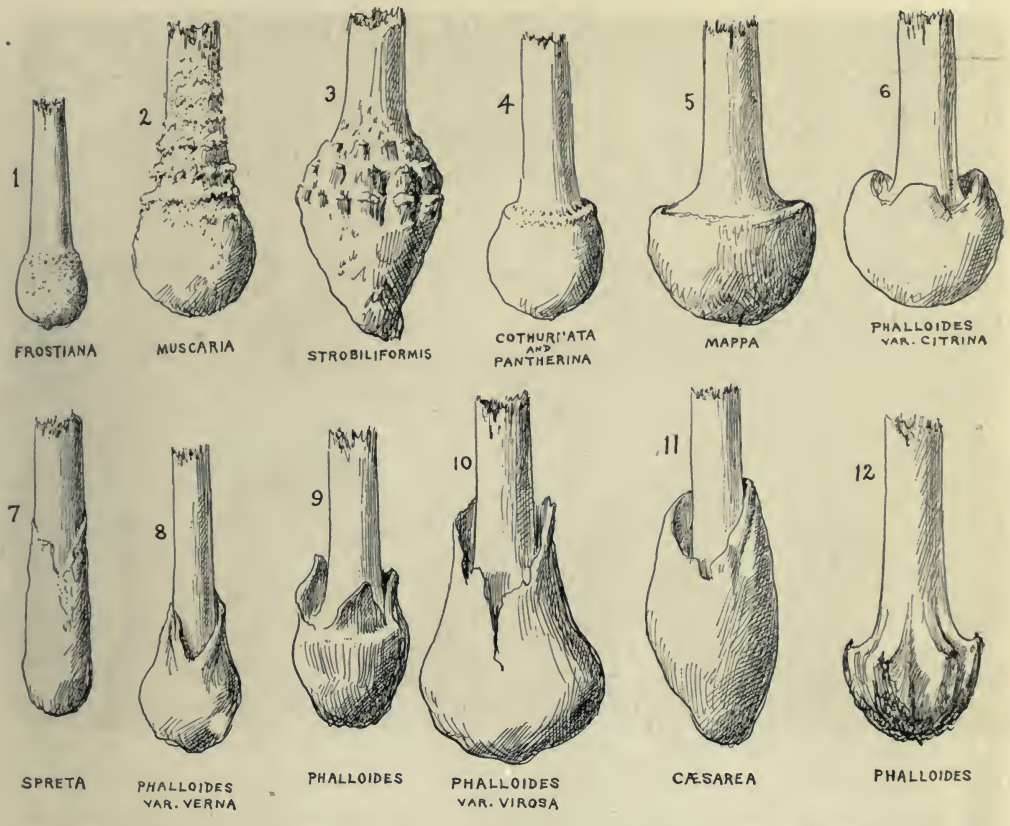
From personal observation, however, and from a perusal of the popular literature which advises the consumption of certain species, we may judge that the following species most frequently find their way into the kitchen: *Agaricus campester, Agaricus arvensis* (see Plate I), the Parasol mushroom (*Lepiota procera,* see Plate XIV), certain species that grow on trees (*Pleurotus ostreatus,* etc., see page 402), ink-caps (species of Coprinus, see Plates VIII and XII), "fairy-ring" mushrooms (see page 397), puff-balls (pages 414-419), and, of course, Morels (Plate VII and pages 420, 421).

Since the establishment of mushroom or mycological clubs in some of our large cities, considerable interest has been aroused, with the result that members and their friends have learned to recognize many of the lesser known, yet equally safe and good species. The war, too, has had its effect. Food is scarce and high-priced, and people, following suggestions offered in the public prints, are turning to hitherto unknown or disregarded sources of food supply, including the spontaneously growing crop of wild mushrooms.

RATTLESNAKE DENS VERSUS POISONOUS MUSHROOMS

But those who, unadvised or ill-advised, would gather wild species for the table should remember that they are embarking upon an adventure that may lead to a sudden and horrible death.

To ask a person to gather his own mushrooms for the table, without previous instruction that will enable him to avoid the deadly kinds, is equivalent to, if not worse than, inviting him to put his unprotected hand into a den of rattlesnakes. Indeed, of the two risky performances, the latter would be the safer; for there are at least two known antidotes for rattlesnake venom, whereas there is none for the poison or poisons of the exceedingly common *Amanita phalloides* (see Plates X and XVI) and its multitudinous forms and varieties.



THE DANGER SIGNALS, OR DEATH-CUPS, WHICH NATURE PLACES ON THE BASES OR UNDERGROUND PORTIONS OF THE AMANITA SPECIES

The death-cup is technically knowu as the volva and at first encloses the entire plant just as the egg-shell does the egg. As the plant grows the stem lengthens, and in doing this ruptures the bag. The illustration shows how the death-cup, or volva, differs in structure with the various species of Amanita. There are two distinct types of death-cups, the bag-like type (Nos. 10 and 11), and the more or less fragile, crumbling, or scaly type (Nos. 1, 2, and 3). Both types are subject to variation, the variations being characteristic for different species or groups of species. Number 7 represents a diabolical attempt on the part of one Amanita to camouflage its identity, both bulb and bag-like volva being difficult to discern. A reduction of the "friable" (crumbling) type of volva is seen in No. 1, only a few grains being left to tell the tale, and sometimes even these are absent. When absent from the bulb, however, they are usually to be found on the ground, leaves, twigs, or needles immediately surrounding the base, or on top of the cap, where they form warts, provided rain has not washed them away. The beautiful *Amanita cæsarea*, Plate IX, and the Blusher (page 390) are two exceptions in the dangerous Amanita family, being edible though possessing death-cups.

In this connection it is of interest to note that poisonous serpents and fungi were associated in the mind of man from early times.

Pliny writes: "Noxious kinds must be entirely condemned; for if there be near them a hobnail or a bit of rusty iron or a piece of rotten cloth, forthwith the plant, as it grows, elaborates the foreign juice and flavors into poison; and country-folk and those who gather them are alone able to discern the different kinds.

"Moreover, they imbibe other noxious qualities besides; if, for instance, the hole of a venomous serpent be near and the serpent breathe upon them as they open, from their natural affinity with poisonous substances, they are readily disposed to imbibe such poison. Therefore one must notice the time before the serpents have retired into their holes."

Were it not that the subject is such a serious one, we should feel inclined to laugh at the simplicity of the ancients.

Photograph by A. G. and B. Leeper

THE BLUSHER (*Amanita rubescens*) IS EDIBLE

There are many thousands of species of mushrooms and many strange forms, as the succeeding photographs show. The collector observes especially variations in the cap (1), gills (2), ring (3), stem (4), volva (see page 389), and color of the spores (for an account of these marvelous reproductive bodies, see pages 392, 402, 415).

Though edible, the Blusher is a member of the dangerous genus Amanita, and should therefore be eaten only by those who are thoroughly familiar with a large number of Amanitas. Its volva has disappeared into warts on the cap, see description of figure 1, page 389. It may be yellowish, entirely white, and often very much deformed or aborted in shape, and quite frequently specimens are found that refuse to "blush." The Blusher is found in thin and dense woods, solitary or scattered; time, July to September; distribution, United States, east of the Mississippi, and in Europe. About natural size. For color figures of Amanitas, see Plates II, V, IX, X, XV, and XVI.

Curiously enough, some of the ancient beliefs as to the origin of poisonous fungi persist at the present time in Italy. A Sicilian laborer whom the writer interrogated on the "funghi," vouchsafed the "information" that the poisonous kinds grow from rusty iron (nails, etc.) in the ground, but that they are easily to be distinguished from the wholesome kinds in the process of cooking by simply dropping a piece of bright silver (a new coin or the like) into the stew: if the fungi are poisonous, the silver will blacken; if not, it will retain its luster. The efficacy of this "test" is believed in by an astonishing number of people.

But not only tradition is active in promulgating error in this life-and-death matter. Newspapers occasionally and inadvertently publish "general rules" that are often misleading. For example, an article in a representative daily in one of our large cities, after assuring the reader that there are but six poisonous kinds among more than a thousand, adds:

"No poisonous mushroom is ever found growing in cluster form."

In refutation of such a generality, the reader is referred to the symptom produced by *Clitocybe illudens,* a poisonous, though not a deadly poisonous, agaric that grows in dense clusters (see Plate III and text, page 403).

GENERAL RULES FOR BEGINNERS

General rules for the guidance of mushroom-hunters are trustworthy and serviceable only when formulated by experienced botanists. The following six rules* by the late Dr. W. G. Farlow, Professor of Cryptogamic Botany in Harvard University, will prevent, if scrupulously observed, the eating of notoriously poisonous species:

"(1) Avoid fungi when in the button or unexpanded stage; also those in which the flesh has begun to decay, even if only slightly.

"(2) Avoid all fungi which have death cups, stalks with a swollen base surrounded by a sac-like or scaly envelop, especially if the gills are white. (Study the Amanitas and diagram, page 389.)

"(3) Avoid fungi having a milky juice, unless the milk is reddish.

"(4) Avoid fungi in which the cap, or pileus, is thin in proportion to the gills, and in which the gills are nearly all of equal length, especially if the pileus is bright-colored.

"(5) Avoid all tube-bearing fungi in which the flesh changes color when cut or broken or where the mouths of the tubes are reddish, and in the case of other tube-bearing fungi experiment with caution.

"(6) Fungi which have a sort of spider web or flocculent ring round the upper part of the stalk should in general be avoided."

Professor Farlow adds that "Rules 1, 2, and 5 may for the beginner be regarded as absolute, with the exception to Rule 2, *Amanita cæsarea* (Plate IX), the gills of which are yellow. Rules 3, 4, and 6 have more numerous exceptions, but these rules should be followed in all cases unless the collector is content to experiment first with very small quantities and learn the practical result."

Other rules that will help to protect from serious poisoning are:

Do not collect mushrooms in or near wooded areas except for study purposes.

This rule is very general, as it does not protect against the green-gilled Lepiota (see illustration on page 393), nor against an occasional Amanita and some others; but it does prevent the beginner from entering the very "lair" of the man-killers.

Do not accept mushrooms from a self-styled expert, even if you have to disoblige a dear friend. Learn the subject yourself.

That an animal (insect, squirrel, turtle, etc.) has eaten of a mushroom is no criterion of the edibility of that mushroom for man. Insect larvæ thrive and grow fat on the violently poisonous *Amanita phalloides* (Plates X and XVI).

Soaking or boiling in water does not render a poisonous species edible.* The poisons of *Amanita phalloides* are destroyed only by continued boiling in powerful acids. (Dr. W. W. Ford.)

* Published in Bulletin No. 15, U. S. Dept. of Agriculture, Washington, D. C.

* J. Henri Fabre, in his "The Life of the Fly," relates that the peasants of Sérignan, in the south of France, render such notoriously poisonous species as *Amanita pantherina* and *Amanita citrina* (Plate V) edible by parboiling in water. Other reliable evidence speaks against this practice, however.

The truth is that inviting any one to become a mushroom-eater is tantamount to asking that person to become somewhat of a botanist, assuming, of course, that one has no ulterior motives on his or her life.

HOW WE MAY ACQUIRE THIS KNOWLEDGE

The preceding paragraphs are likely to dampen the ardor of those who would be pleased to learn how to collect and select their own mushrooms, but who are not sufficiently interested to go to the length of acquiring the necessary knowledge that will enable them to do this with safety. Those who are so affected had better do without mushrooms for the rest of their lives, bearing in mind that, so far, there is no "player attachment" to the study of mushrooms.

The most expeditious way of acquiring this knowledge is to join a mushroom club, if there happens to be such an organization in the city of one's residence. Boston, Philadelphia, Washington, and Detroit have, or have had, such clubs.

MUSHROOMS ARE THE FRUIT OF FUNGI

The removal of the bark from a rotting tree-trunk or the disturbance of the dense mat of decaying leaves on the floor of the forest will reveal fine threads, usually white in color. These threads may be loosely scattered and mould-like, compacted into a dense meshwork of cords, or spread out in flat sheets of the texture of white kid leather. In old mines the timbers are often festooned with long streamers of this soft substance, which to botanists is known as "mycelium," to mushroom growers as "spawn."

As every one who has cultivated these plants knows, mushrooms grow from these threads, not, however, as the apple tree grows from its roots, but rather as the apple grows on the tree, for the mycelium is the plant, the mushroom the fruit.

THE MARVELOUS SPORES

Every mushroom species arises from a mycelium of its own; yet, to distinguish between species, students rely exclusively on the forms, colors, and microscopic characters of the fruit-body (the mushroom), the mycelium rarely presenting characters sufficiently distinct for identification purposes.

The forms of mushrooms are extremely varied, but all have in common the ripening and liberation of the microscopic spores ("seeds" or reproductive bodies), by means of which the species are enabled to spread over wide areas. Some of the remarkable qualities of these spores are told on pages 402 and 415.

The mushroom collector can make some interesting experiments with the spores, as follows:

If the expanded cap of the common pasture mushroom (*Agaricus campester*) (see Plate I) be removed from its stem and placed upon a sheet of white paper, gill side downward, and left there under cover of a finger-bowl for an hour or two, there will be formed a beautiful deposit ("spore-print") of the microscopic, purple-brown spores.

If an Amanita (Plates II, V, IX, X, XV, and XVI), a Lepiota (Plate XIV), a Tricholoma (Plate VII), a Clitocybe (Plate III), or an Armillaria (Plate VI) be treated in the same way, a white spore-print will result. With a Volvaria (Plate V) the deposit will be reddish or pinkish. Pholiotas (Plates VIII and XIII) and Cortinarii (Plate VII) will throw down spores of some shade of brownish yellow, rusty brown, or cinnamon. Coprinus (Plates VIII and XII) and Panæolus (Plate VIII) species precipitate black or blackish spores.

Similar experiments may be made with other varieties.

FUNGI IN NATURE'S ECONOMY

The Fungi, a class of plants of which mushrooms are the most familiar examples, play an important rôle in their influence on the higher forms of life. As parasites on plants, animals, and man, they cause destruction on an almost incalculable scale. As scavengers and as rock-disintegrators, on the other hand, they accomplish work that is basic for the very existence of all life.

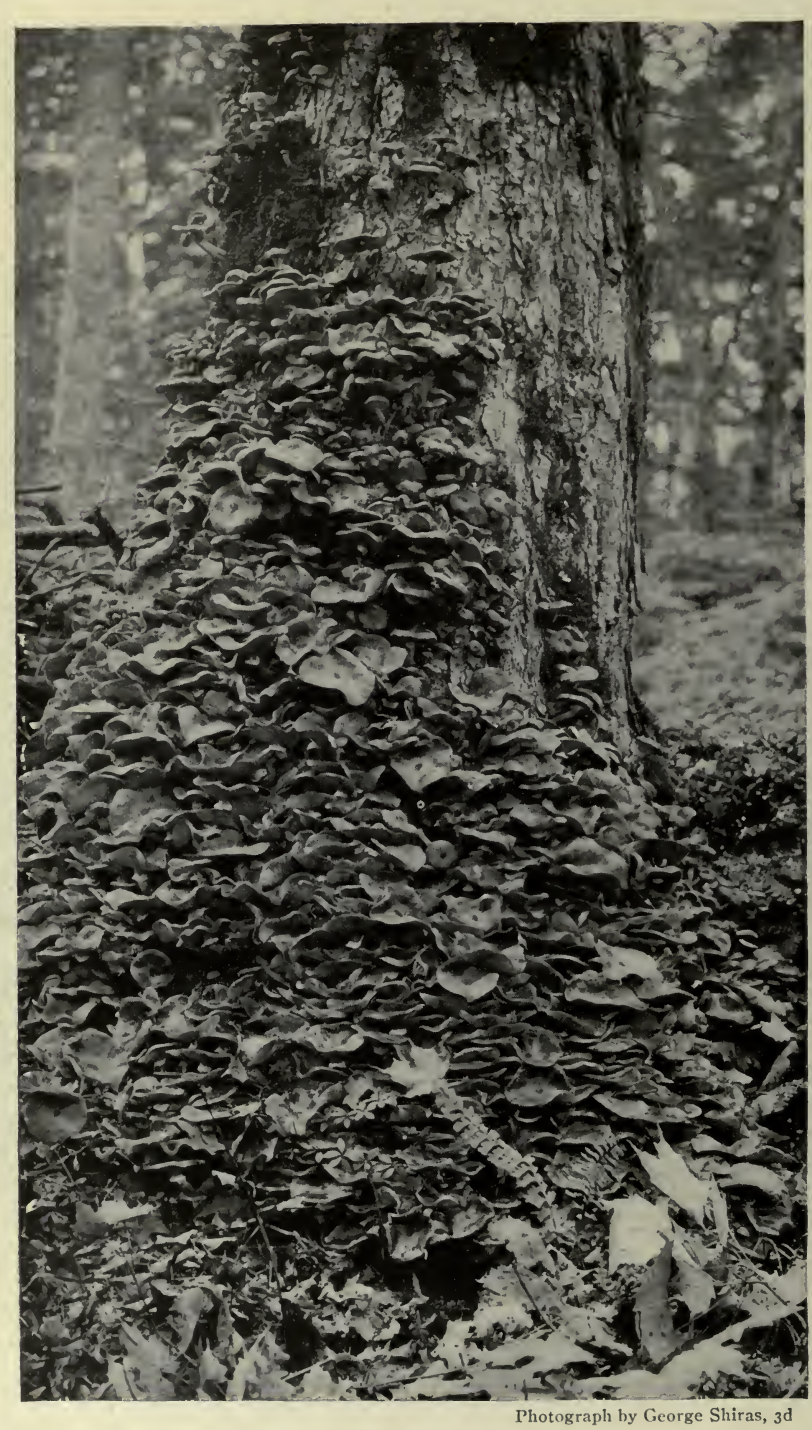
Rock is the raw material of the farmer's soil; but before the farmer can have this soil it must first be made. How is it made?

Violent weather changes—heat, cold, rain, snow, and ice—start the breaking-up process. Associated with these agencies, the lichens begin their work. Dry, crusty things, these plants produce an

Photograph by C. Cramer

THIS GREEN-GILLED LEPIOTA (*Lepiota morgani*) IS POISONOUS

Beware of this false Parasol mushroom. It differs from the true edible Parasol mushroom (Plate XIV and page 439) in its greenish gills, coarser scales, and larger size. These two young specimens were photographed on a lawn in Washington, D. C. Approximately natural size. This Goliath of Mushrooms, the green-gilled Lepiota, is especially plentiful in the Mississippi Valley, but it also occurs in the Middle and South Atlantic States, in South America, in the West Indies, and probably in Bohemia and in the Philippines. Its habitat is in rich pastures, cultivated ground, in open woods, and on lawns in cities; time, June to October.



Photograph by George Shiras, 3d

THE EDIBLE HONEY-MUSHROOM (*Armillaria mellea*) "FINISHING" A TREE

This mushroom is the bane of the orchardist. The growth extended eight feet up the maple tree and four feet at the base (see text, page 411, and Color Plate VI, upper figure, and opposite page).

Photograph by George Shiras, 3d

"A TRAGEDY IN THE FOREST"

Armillaria mellea is here shown at its destructive work. This tree is doomed. This species of fungus is also shown as the upper figure of Color Plate VI and on opposite page. If you chop off the mushrooms, others will soon replace them, for they are simply the fruit of a parasite infesting the tree (see page 392 and the bracket fungus, page 409).

THE ABORTIVE CLITOPILUS (*Clitopilus abortivus*) AND ABORTIVE FORMS, THE LATTER SHOWN ON THE RIGHT. EDIBLE. ONE-HALF NATURAL SIZE

The eye that is sensitive to subtle color arrangements always meets with pleasure the unobtrusive habitant of our woodlands, known as the Abortive Clitopilus. When specimens are found, they are almost invariably accompanied by the odd, puff-ball-like masses, 1¼ to 2½ inches in diameter, irregular in shape, and of a whitish tint, shown in the right of the photograph. It would be interesting to ascertain whether these queer masses are caused by insects or by some parasitic fungus. An inspection of the interior will show that there is no differentiation of tissues into cap, stem, and gills. Similar masses are found accompanying the Honey mushroom (see Color Plate VI) and other species. Both the perfectly developed and the aborted forms are edible. They should be thoroughly cooked to bring out the flavor.

Photographs by A. G. and B. Leeper

THE GREENISH RUSSULA (*Russula virescens*). EDIBLE

The various Russulas are difficult to distinguish from each other. This species, however, is sufficiently well marked to be recognized by the layman. Painted with the hues of the rainbow, the Russulas bring a touch of brightness into the gloomy depth of the forest. Vivid reds, greens, purples, violets, and yellows predominating, these conspicuously colored agarics are at the same time the joy of the painter and the despair of the student who attempts their classification. The Greenish Russula grows in thin woods and in grassy, open places; time, July and August; distribution, Maine to Virginia, and west to Ohio and Michigan; also in Europe. About one-half natural size.

THE FAIRY-RING MUSHROOM (*Marasmius oreades*). EDIBLE

The specimens shown grew in the grounds of the White House, Washington, D. C. Approximately one-half natural size.

Photographs courtesy of U. S. Department of Agriculture

A "FAIRY-RING" FORMED BY *Marasmius oreades*, ONE OF THE BEST EDIBLE MUSHROOMS

The beginning of a "fairy-ring" may be a single mushroom which drops its spores or seeds in a circle about the base. The next season the small ring of mushrooms drops a larger ring of spores, and so the circle expands, year by year, exactly as the ripples spread out on the surface of a millpond when a rock is cast into the water. Fairy-rings, formed in Colorado, have been estimated to be about 600 years old. Legend informs us that these rings are the magic circles within which elves and other nimble fairy folk hold their revels at midnight on our lawns. There is another superstition that the rings mark the spots where bolts of lightning have struck the ground. *Marasmius oreades* is found in grassy places (lawns, pastures, and by the roadside) from May to October, being widely distributed in both the North and South Temperate zones.

THE VELVET-STEMMED COLLYBIA (*Collybia velutipes*). EDIBLE

In winter time the mushroom lover yearns for a taste of wild species. This he may have if he will be on the lookout for this tree-inhabiting Collybia. About one-half natural size. With its stem encased in a suit of dark-brown velvet, its rich yellow cap protected by a mucilaginous covering, the plant is admirably adapted to stand the rigors of the boreal season. This mushroom is gathered in the spring, autumn, and winter; distribution, eastern United States as far west as Kansas and Iowa; probably in the Pacific Coast States; also in Europe and Mexico; a variety (*spongiosa*) in Alaska.

Photographs by A. G. and B. Leeper

THE ROOTED COLLYBIA (*Collybia radicata*). EDIBLE

With its yellow-brown, wrinkled caps perched on a tall stem, this Collybia is met with almost immediately one enters a beech or pine forest. About one-half natural size.

acid that crumbles the hardest rock. Rains wash the disintegrated particles into cracks, crevices, and crannies down a slope. The remains of the dead lichens are added to the débris to form the first beginnings of soil in which other lichens, small ferns, and seed plants find a place to thrive and eventually die, each plant leaving behind some small particles of matter. Gradually, with infinite patience, Nature thus deposits soil in the valleys.

Ages of this slow but cumulative work, in which soil bacteria and other fungi play an essential rôle, and we have rich, virgin soil ready to receive the precious grains of wheat. Then the eye of hungry man is gladdened by the sight of acres of the golden crop.

FUNGI RAISE THE DOUGH

Bread made from unleavened dough is not to the taste of most of us. It must be light and spongy to be palatable. To obtain these qualities we are again dependent on the fungi. The good housewife buys yeast, dissolves it in water, and adds the fluid to the heavy dough, which is then thoroughly kneaded and set aside overnight in a suitable temperature. The next morning she is pleased to note that the dough has risen. After further kneading, it is placed in the oven and baked into appetizing loaves. On being cut, the bread exhibits a multitude of small bubbles of nearly equal size.

The little Brownies that labored while others slept are microscopic fungus cells that were introduced with the yeast. Given sugar, starch, moisture, and warmth, these cells multiply with incredible rapidity, at the same time giving off carbon-dioxide and another product. The carbon-dioxide gas collects in bubbles, and thus distends and lightens the dough.

If bread be left in a moist place it will mould. Here, too, we have fungous action.

Moulds, like bacteria and yeast fungi, are ever present and ready to alight and feed upon organic substances suitable to their taste. Roquefort cheese owes its flavor to a certain mould. Another is known to plug up the human ear.

Some of the industries in which the action of the ferment fungi is essential are: The making of buttermilk and cheese, the tanning of leather, tobacco-curing, the fermentation of vegetables (sauerkraut, fodder in silos, etc.), all bread-making where yeast is used, and all fermentation processes in which alcohol is produced.

FUNGI DESTROY WHEAT, TREES, AND WOOD

In 1916 the black-stem rust destroyed in the United States and Canada 280,000,000 bushels of wheat. Add to this a 15 to 25 per cent reduction of the barley and oats crops, and we become aware of the appalling destruction that a single fungous disease can cause.

One of these, *Endothia parasitica*, threatens with extinction the glorious chestnut trees of our eastern coast. The disease caused by this fungus fiend, the chestnut bark disease, starting in the vicinity of New York City about 1904, spread rapidly as far north as New Hampshire and south to Virginia. In its devastating march it has destroyed timber valued at more than two hundred million dollars, and the end is not yet.

Another disease, the white pine blister rust, though not yet as widely known as the chestnut disease, is likely to become so unless preventive measures are adopted and coöperatively carried out by the States concerned.

While the destruction of living woody tissues is steadily going on in the forests, dead wood, including that used in buildings, railroad ties, etc., is likewise being destroyed by species that specialize in saprophytism or scavenger-work.

ANTS "CULTIVATE" MUSHROOMS

The almost human sagacity of the ant has interested man from earliest times. Isn't it possible that Homer called the Thessalian legions "myrmidons" because they swarmed like ants and fought with the cunning and bravery of these insect warriors? The foresight exhibited by the ant in storing its food, furnished Æsop with the theme for one of his most delightful fables. Later, upon closer observation, we were startled to learn that Mr. Ant is also a good "dairyman,"* milking his "cows" whenever he wants "milk"; but it was not until recently that

* See "Notes About Ants and Their Resemblance to Man," by Dr. William Morton Wheeler, in the NATIONAL GEOGRAPHIC MAGAZINE, August, 1912.

Photographs by A. G. and B. Leeper

THE COMMON MEADOW MUSHROOM (*Agaricus campester*). EDIBLE

Brownish, scaly variety above; white, smooth variety below. Before the war America imported annually millions of pounds of this delicacy from France, and our own producers and bountiful Nature have assisted materially in meeting the ever-increasing demand. Do not attempt to gather this or any other mushroom for eating purposes unless you have a competent authority with you (see Color Plate I and text, page 401). When picked they will fruit again as a continuous crop when cultivated in special mushroom cellars, and out-of-doors as long as the weather is propitious.

Photograph by A. G. and B. Leeper

THE BRICK-RED HYPHOLOMA (*Hypholoma sublateritium*). EDIBILITY DOUBTFUL

Few mushrooms are commoner than the Brick-top. It grows in dense clusters at the base of old chestnut and oak trees. About one-half natural size.

we were apprised of the fact that mushroom-growing is also one of his accomplishments.

Scientific travelers in Java and South America record that some of the larger species, the termites, construct veritable mushroom-cellars, in which they "cultivate" (on the mycelium of some large fungi) little globular bodies as food for themselves.

Mushroom-growing is a most uncertain business unless conditions favorable to the growth of the spawn are rigidly maintained. The ants know this, too, and take precautions necessary to insure a good "crop."

THE COMMON MEADOW MUSHROOM (Agaricus campester)

(*See Color Plate I*)

When the average person uses the word "mushroom" the common Meadow mushroom, or Pink Gill (*Agaricus campester*) is meant (see Color Plate I and photographs on page 400). Imported from France in enormous quantities before the war; cultivated by our own growers with ever-increasing zeal, and gathered in the wild state as soon as it makes its appearance in the fall, it is so well known that even the most timid feel no hesitation in ordering their juicy tenderloin "smothered with mushrooms."

The records, however, show that not infrequently other deleterious species are eaten along with, or in the place of, the common mushroom. It therefore behooves the eater of mushrooms to be as cautious with this species as he would be with one less well known.

Of course, only the most careless or uninformed would mistake the poisonous Amanitas for the Agaricus; but there are other poisonous species, not necessarily deadly, that are apt to get by the eye and into the mouth if one is unaware of, or neglects to observe, the botanical characters that distinguish the good from the bad. Species that are likely to be mistaken for the common mushroom are discussed further on.

Remarks on the preparation of the Meadow mushroom for the table are superfluous, as any cook-book will give full directions.

The common Meadow mushroom is at home in grassy places, lawns, pastures; never in thick woods; also (when cultivated) in cellars, caves, abandoned mines, and in other places where the temperature can be held between 50° and 65° F. and where moisture conditions can be controlled; time, when growing wild, in August and September, occasionally in the spring; when cultivated under suitable conditions, throughout the year; distribution, cosmopolitan.

Photograph by A. G. and B. Leeper

THE OYSTER MUSHROOM (*Pleurotus ostreatus*). EDIBLE

The name of the luscious bivalve was given this species because of a fancied similarity in appearance. The plants may be found from June until late in the Autumn, growing on deciduous trees. About one-third natural size.

If one has discovered one or more trees that bear Pleuroti, it is a good plan to water the spots from which specimens have been taken. In this way the plants may be "cultivated," as new "fruit" will appear in a week or two.

When specimens are brought indoors and placed in a sunny nook, away from drafts, the interesting phenomenon of spore-discharge may be watched. Like twisting, curling spirals of smoke from the burning end of a cigar, the fine spore-rain drifts off into space in quest of tree wounds where it may lodge and start a mycelium that in turn will produce more Pleuroti.

Related species and poisonous species are sometimes eaten in place of it, though *Agaricus campester* is so well marked that it is inconceivable how poisonous species, especially Amanitas, can be eaten by mistake.

A mere glance at the illustrations of the common mushroom and those of the Amanitas (see Plates II, V, X, XV, and XVI) ought to prove instructive, even to the most superficially observing, and, if in addition the descriptions be compared, wide differences will at once become apparent. To call attention to a few: *Agaricus campester* has a squattier appearance; lacks a bag, or volva; has pink gills that turn to a chocolate brown, and never grows in woods or forests, preferring rich, well-manured ground, such as old pastures, where horses are turned loose.

The Amanitas rarely occur anywhere except in woods, or in places where woods have recently stood, such as lawns in new suburbs; throw down from their gills a white spore-powder, and have, in addition to the ring, a more or less pronounced volva at the usually bulbous base of the stem (for figures of the various forms of the Volva, or Death-cup, see Nature's Danger Signals, page 389).

THE FIELD, OR HORSE MUSHROOM (Agaricus arvensis). Edible

(*See Color Plate I*)

This coarse and heavy species is edible only when young and tender. Some epicures object to its anise-like odor. The distinguishing features are: its large size (breadth of cap sometimes more than a foot); peculiar ashy-pink tint of the young gills; large, thick, double ring (the lower one split radiately); the bulbous stem, and the tendency to turn yellow on the slightest bruise.

It is not so choice in its habitats as the common mushroom, growing in cultivated fields, grassy pastures, in waste places, under old hedges, and occasionally near trees, and in the borders of thin woods. It should be sought from July to September. Occasionally it forms huge fairy-rings (see page 397).

THE FLY MUSHROOM (**Amanita muscaria** and its varieties). Deadly poisonous!

(See Color Plate II for mature plant and Color Plate XV for young specimens)

Beauty, though attractive, is often deceptive. This is admirably illustrated in *Amanita muscaria*, the "most splendid chief of the agaricoid tribe," as Greville, an eminent Scotch botanist, describes it.

"In the highlands of Scotland," he continues, "it is impossible not to admire it, as seen in long perspective, between the trunks of the straight fir trees; and should a sunbeam penetrate through the dark and dense foliage and rest on its vivid surface, an effect is produced by this chief of a humble race which might lower the pride of many a patrician vegetable."

Contrast with this the dire effects of its poisons on the human system. Very shortly after eating the fungi (from one to six hours, depending upon the amount eaten) the victim exhibits excessive salivation, perspiration, flow of tears, nausea, retching, vomiting, and diarrhea. The pulse is irregular and respiration accelerated. Giddiness and confusion of ideas are also present.

Delirium, violent convulsions, and loss of consciousness develop in rapid succession when large quantities have been eaten, the patient sinking into a coma that is followed by death. In light cases the patient, after an attack of vomiting and diarrhea, falls into a deep sleep, from which he awakes several hours later profoundly prostrate, but on the road to recovery. Within two or three days, in such cases, complete recovery takes place.

Atropin is the perfect physiological antidote for muscarin, one of the poisons present. However, being a poison itself, it should not be administered except by a physician. The early appearance of the symptoms is characteristic of poisoning by this species, those caused by *Amanita phalloides* presenting themselves much later (see this species, Plates V, X, and XVI).

The *Amanita muscaria* is very common in woods, thickets, in open places, and sometimes in pastures, from June until the first frosts.

Photograph by George Shiras, 3d

A SPECIES OF PLEUROTUS MUSHROOM GROWING FROM A FALLEN LOG

A sight such as this is calculated to make the mushroom-hunter's mouth water. Note that the central, eccentric, or lateral attachment of the stem to the cap is a matter of position of growth; the caps on the side of the log have lateral stems, those on the top central, or very nearly central, ones (see illustration, page 402).

THE JACK-O'LANTERN MUSHROOM, OR FALSE CHANTRELLE (Clitocybe illudens). Poisonous

(See Color Plate III)

To see light emanating from a mushroom is at least a novel experience that is possible if one views perfectly fresh specimens of the Jack-o'-Lantern by night; but this is the limit of its interest for us. As an edible species, it is not to be thought of; for, though pleasant enough to the taste and enjoyed without inconvenience by some, it acts as a powerful emetic with most people. Moreover, recent chemical investigation of the plant has demonstrated the presence of muscarin in its tissues, the same substance that plays such an important rôle in poisoning by *Amanita muscaria* (see text on this page).

Dense clusters of this Clitocybe may often be seen growing on or about old stumps of chestnuts, oaks, and other deciduous trees. Occasionally, such clusters contain hundreds

Photograph by A. G. and B. Leeper

THE GLISTENING COPRINUS (*Coprinus micaceus*). EDIBLE

Soon after the first showers in April this tiny ink-cap emerges from the ground in clusters of hundreds of individuals. The best harvesting implement is a pair of scissors. It grows at the base of old trees, stumps, and from buried wood in lawns. Caps tawny, and glistening with minute, mica-like particles; stems white. About natural size (see figure, lower left, Color Plate VIII).

of individuals. It should be looked for in the autumn.

The caps often measure as much as ten inches across, the stems being proportionately long.

Pleurotus olearius, another phosphorescent mushroom that parasitizes the olive tree in southern Europe and is also poisonous to human beings, is closely related to, if not identical with, this plant.

EDIBLE AND POISONOUS FLESHY TUBE-FUNGI (Various species of Boletus)

(*See Color Plate IV*)

Though similar in shape, the fleshy tube-fungi differ in one important point from the gill-fungi; instead of gills, the under side of the cap exhibits a layer of small, vertically placed tubes, on the inside of which the spores are borne.

The Boleti are fairly safe; yet the beginner ought to be forewarned against certain species that are likely to cause illness when eaten. Chief among these is a group collectively known as the Luridi. The prime distinguishing mark of species belonging to this group is the more or less bright red, orange-red, or maroon coloring of the tube-mouths; also, all Boleti that show the slightest tendency to assume some shade of blue when broken or bruised should be avoided. Bitter species, too, should not be eaten, especially *B. felleus,* a somewhat robust plant with pinkish flesh-colored tubes.

The edible Boletus, the cèpe of commerce (*Boletus edulis*), Plate IV, is the well known and much sought *cèpe* of the French. Before the war, a regular article of commerce, one could purchase it, either dried or canned, at the little delicatessen shop "around the corner." Now we are dependent upon our own supply, which is none too plentiful. In the coast counties of California, however, it seems to be fairly abundant, for the writer has seen Italian

Photograph by Roland McKee

THE INKY COPRINUS (*Coprinus atramentarius* VARIETY). EDIBLE

This variety lacks the fine scales on the top of the cap, which are prominent in the typical form. The very delicate silvery gray luster of the cap vanishes with the slightest touch. The "ink" from this mushroom makes a forgery-proof writing fluid (see page 439). Natural size.

residents there return from collecting trips with their automobiles laden with them.

In preparing it, either for immediate use or for pickling or canning, the layer of tubes and the tough portion of the stems should be removed. When used fresh, the cooking should be rapid over a brisk fire. Frying or broiling with butter or olive oil, with the usual spices added, seems best adapted for this fungus. When pickled, add cloves, bay leaves, and other spices.

Except for the stem, which is at times much shorter, and club- or pestle-shaped, the illustration shows a fully matured plant. When young, the tubes are pale, creamy white, but as the plant develops they become greenish, and when touched or bruised change to a greenish-ocher color, *not to blue.*

The species is extremely variable, both as to shape and color, some specimens showing a brownish-lilac color on both cap and stem. The constant features, however, are the colors and color changes of the tube layer, and the fine mesh of white lines on the stem, usually but not always confined to the upper part.

The edible Orange-cap Boletus (*Boletus versipellis*) is much coarser and larger than the cèpe and not so desirable. Still, in the absence of something better, it is eaten by those who must have their mushrooms (see page 406).

It is quite common and easily recognized by the numerous rough, blackish points on the stem and by the overlapping margin of the reddish- or orange-colored cap. Its flesh changes color to a neutral, reddish gray.

Photograph by A. G. and B. Leeper

THE ORANGE-CAP BOLETUS (*Boletus versipellis*). EDIBLE (SEE COLOR PLATE IV FOR ANOTHER SPECIES OF BOLETUS)

A large, coarse, tube- instead of gill-bearing plant with a reddish-orange cap, overlapping margin (of the cap), and rough, black-dotted stem (see text, page 405). Compare the under side of the cap with that of the common mushroom (page 400) and other gill-mushrooms included in this article. In the fleshy tube-fungi, instead of gills (see page 390), the under side of the cap exhibits a layer of small, vertically placed tubes, on the inside of which the spores (see pages 392, 405, and 415) are borne.

Photograph by A. G. and B. Leeper

THE EDIBLE BEEF-TONGUE MUSHROOM (*Fistulina hepatica*)

Cap blood-red, pores (on under side of cap) creamy pink, flesh streaked with red and pink, this fungus grows on chestnut and oak stumps from July to October. The plant is so distinct that it is not easily confounded with other species. The illustration is about one-half natural size.

THE HANDSOME VOLVARIA (Volvaria speciosa). Edibility doubtful

(*See Color Plate V*)

Opinion as to the edible qualities of the Handsome Volvaria diverges considerably. While some speak of it as "a fine edible agaric," others pronounce it "watery and unpleasant to the taste," or even poisonous. Since the plant is somewhat variable, and therefore not clearly separated, except by spore characters, from the very poisonous *Volvaria gloiocephala,* it is advisable to let it alone.

Only recently Prof. W. C. Coker, of the University of North Carolina, reported a variety of *V. speciosa* from the sand dunes of Smith Island, North Carolina. His plant had spores larger than those of the type and differed in other characters.

In the eastern United States it is of infrequent occurrence, but on the Pacific coast, especially in California, it is so abundant during April and May that one finds it wherever the soil is rich with decaying vegetable matter.

The odor of the fresh plant is repellent, resembling very markedly that of rancid lard.

The Handsome Volvaria is gathered from April to October; distribution, temperate North America, Europe, and North Africa.

CORAL MUSHROOMS (Various species of Clavaria). Edible

(*See Color Plate V*)

"But that is not a mushroom!" exclaims the tyro, seeing his first Clavaria. "Why, it looks like coral."

It is true that these plants show no differentiation into cap, gills, tubes, or teeth, but they are, nevertheless, true fungi, the spores being borne on the exterior of the branches.

With the exception of a single species, all, so far as known, are good to eat, provided the taste is agreeable and the specimens are fresh and free from insect attack. The exception is a species (*C. dichotoma*) in which the branches are rather thin, flaccid, whitish, and divided regularly into twos.

Clavaria fusiformis (see Color Plate V) is long, bright orange-yellow with a delicate bloom, dark-tipped, and usually grows in tufts. The interior is solid at first, then hollow. Occasionally specimens are found that are variously bent, twisted, or malformed.

Clavarias may be sought in both deciduous and coniferous woods from July to September (see illustration, page 412).

Other edible species are *Clavaria flava* and *Clavaria botrytes.*

Photograph by A. G. and B. Leeper

THE EDIBLE *Polyporus frondosus*

Dense masses of this tree fungus may be found growing at the base of oaks and other trees. The color of the upper surface of the caps is a sooty-gray; that of the lower, finely porous side, white. The illustration is about one-third natural size.

Photograph by George Shiras, 3d

A BRACKET-FUNGUS (*Polyporus applanatus*)

Note the concentric zones marked with match-sticks. Each zone indicates the limit of a year's growth. The under side of this woody fungus makes an admirable sketching surface. A sharp twig will do for a pencil. The bracket fungus is the fruit-body of a destructive parasite very common in our forests (see page 417). You do not rid the infected tree of its fungus parasite by removing the fruit-bodies. The disease is produced by the mycelium (or spawn) threads, which (more or less compacted into tissues) permeate the wood of the tree. This particular species has a whitish, porous surface, which is easily embrowned on the slightest touch—hence its use as a sketching surface.

THE DEADLY AMANITA, OR DESTROYING ANGEL (Amanita phalloides and its varieties). Deadly poisonous!

(*See Color Plates V, X, and XVI*)

"Do not eat mushrooms and you will not be killed by them."

If every one followed this injunction, further advice would be superfluous. That it is not universally followed is certain, for each year brings new records of poisoning cases, most of which are caused by species of Amanita. The first duty of those who insist on eating mushrooms is, therefore, to become thoroughly familiar with the botanical features of this genus. These once impressed upon the mind, the danger from Amanita poisoning will be much reduced if not entirely eliminated.

The following characterization of Amanitas should be memorized by the beginner as he would memorize a theorem in geometry:

Any white-spored, more or less free-gilled fungus that possesses both ring and volva is a member of the very dangerous genus Amanita (see chart, page 389).

Extremely common in all parts of the country from June until the first frosts, the deadly Amanita grows singly or scattered, in and near both deciduous and coniferous woods, in the soil, among leaves, particularly where the ground is low, wet, and not too sandy; also in places where woods have recently been cut down, such as lawns, pastures, and fields in new suburbs.

The symptoms of poisoning from this fungus appear much later than those due to *Amanita muscaria*. The unfortunate victim remains quite well until seized suddenly with violent abdominal pain, in from six to fifteen hours after eating the fungi. Excessive vomiting, thirst, and either diarrhea or constipation accompany the abdominal pain.

The paroxysms of pain may be so severe that the face becomes drawn, pinched, and of a livid color (Hippocratic face). The attacks of pain and vomiting come on periodically, the patient loses strength rapidly, jaundice frequently sets in, and coma finally develops, fol-

Courtesy of Dr. George T. Moore, Director of the Missouri Botanical Garden, St. Louis, Mo.

THIS EXQUISITE CORAL HYDNUM (*Hydnum coralloides*) IS EDIBLE

It is said that the illustrious Swedish botanist, Elias Fries, was attracted to the study of fungi on beholding a specimen of this species growing in a forest of his homeland. Size: Individual clumps up to 10 inches.

Photograph by George Shiras, 3d

AN UNUSUALLY BEAUTIFUL CORAL MUSHROOM (*Hydnum laciniatum*) GROWING ON A PROSTRATE TREE

The species is closely related to *H. coralloides,* shown on page 410. It is edible when white and fresh. Size: Individual clumps up to 10 inches.

lowed by death. Convulsions may or may not occur toward the end.

The duration of the illness is from three to eight days, depending upon the age of the patient and upon the amount of fungus eaten. There is no known antidote for the poisons, and the death-rate is, therefore, very high, ranging from 60 to 100 per cent.

A description of *Amanita phalloides* and its varieties: Cap 2 to 6 inches broad, fleshy, at first egg-shaped to bell-shaped, then obtusely convex, finally plane or depressed (concave when old and overexpanded), usually a little elevated in the center, but not umbonate, white (in the spring form, *A. verna,* and in *A. virosa,* the latter illustrated in Plate X), light yellowish-white, dull yellow or light brown, grayish, grayish-brown or olive-brown (livid purplish-brown in *A. porphyria*), the disk frequently darker in some individuals, approaching black (see Plate XVI), citron-yellow (*A. citrina,* illustrated by the figure on the extreme right in Plate V), greenish yellow, green or olive-green, occasionally streaked with darker shades of the prevailing color or with dull reds.

THE HONEY-COLORED MUSHROOM, OR OAK FUNGUS (Armillaria mellea). Edible

(Upper figure, Color Plate VI)

Tête de Méduse is a French common name for this agaric, the appearance of which in an orchard is as much feared by the owner of the trees as was the Gorgon head of old.

Its appetite for living, ligneous substance is truly astounding. With equal zest it feeds upon oaks, chestnuts, pines, larches, hemlocks, and white cedars, reserving for dessert the grapevine and most fruit trees. When times are hard and "pickins' slim," it turns upon the humble potato. Once, so far as we know, its attack was met, and this by an orchid. After a battle for supremacy, the two finally came to an understanding and decided to work together for their mutual benefit.

Like most successful organisms, it has a great capacity for adapting itself. Equally at home on plains, mountain peaks, and in mines, it pursues its prey relentlessly, its rapid propagation being aided by blackish cords (rhizomorphs) that do reconnoitering duty under the ground and under the bark of trees. Even the orchardist plowing over the site of a tree killed by the Armillaria unwittingly assists in its distribution by scattering fragments of these rhizomorphs over new feeding ground.

Much work has been done to combat this fungus pest, latest among which is that by Prof. W. T. Horne, of the University of California.

As might be expected in so widely distributed and adaptable a plant, its tendency to vary, both in color and in structure, is almost limitless (see pages 394 and 395).

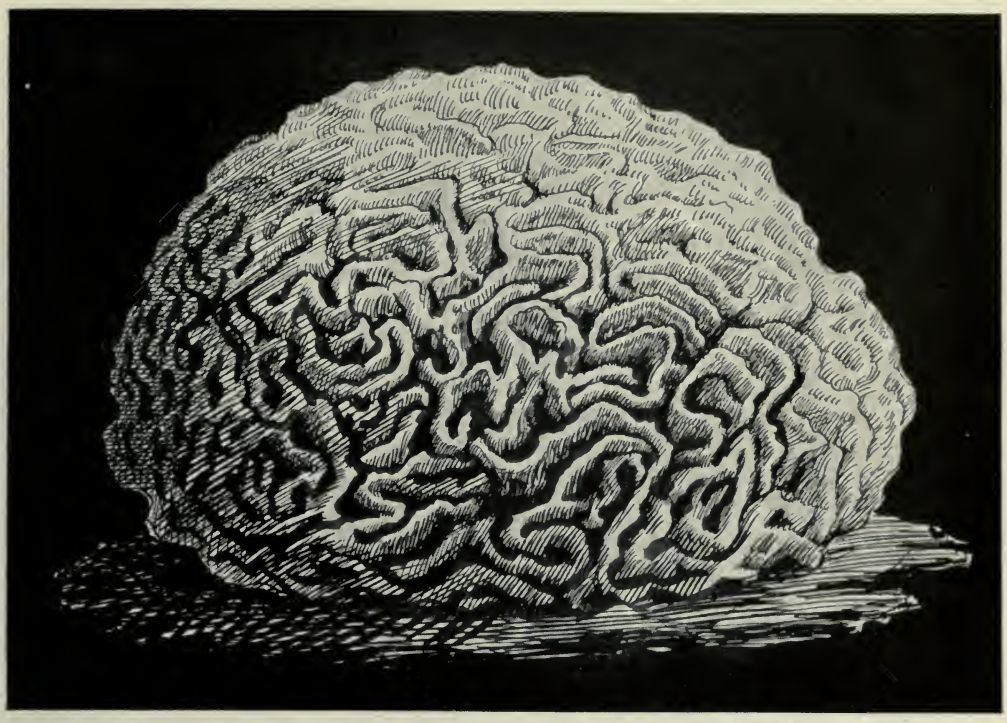
THE HEDGEHOG HYDNUM (*Hydnum erinaceus*). EDIBLE

Not infrequently the assiduous mushroom-hunter, "new to the game," finds specimens that do not tally with his conception of what a mushroom should be like. This is one of those surprises. Whitish to creamy-white when fresh. Somewhat under natural size.

Photographs by A. G. and B. Leeper

A CORAL MUSHROOM (*Clavaria flava*). EDIBLE

The novice seeing this remarkable growth for the first time finds it difficult to believe that it is a mushroom. Branches pale yellow; base and main stems white. Common in woods from July to September. Somewhat under natural size. (For another Clavaria, see Color Plate V, middle figure.)



A HUGE, CONSPICUOUS MUSHROOM SOMETIMES FOUND IN FORESTS (*Sparassis herbstii*). EDIBLE

This rare and beautiful fungus should be looked for in oak woods. About one-half natural size.

Because of the acrid taste that is usually present in the raw plant, it is not rated very high as an edible species.

This mushroom grows wherever there is wood to be attacked in the open, commonly in woods, on the ground, or on decaying stumps and trunks of trees, singly, scattered, or in dense clusters; time, mainly in the autumn, though it may occur as early as June; distribution, cosmopolitan.

THE GARLIC MUSHROOM (Marasmius scorodonius). Edible

(*See Color Plate VI*)

Some people enjoy the flavor of garlic. To these it will be interesting news that they may have their garlic in mushroom form if they will enter a pine or spruce forest. Here, in vast hordes, covering the fallen twigs, sticks, and needles, grows the little Marasmius. One cannot mistake the plant, for the odor is so pronounced that the "nose knows" it before the eye sees it.

It may be used like garlic, in dressings, and as a flavor for roasts, etc. Since it occurs in great abundance and dries readily, it can be stored for use in the winter, when it will also prove a reminder of the pleasant days spent in mushroom-hunting. The dried plants must be steeped in water before they are employed in the kitchen.

The Garlic mushroom grows in woods, especially of pines, on needles, twigs, etc.; time, July to October, very plentiful after heavy rains; distribution, temperate North America and Europe; also in Siberia.

THE LITTLE WHEEL MUSHROOM (Marasmius rotula). Edible

(*See Color Plate VI*)

After a summer shower it pays to scrutinize closely the decaying débris of a near-by wood. Almost certainly one will see on bark, roots, and old leaves tufts of this delicate and marvelously made little agaric.

Note particularly the manner in which the hair-like stem is set into the tiny socket, the sparsity of the gill development, and the fine furrows and scallopings of the margin of the cap. A Swiss watchmaker could not excel such workmanship.

During dry weather the plants shrivel into invisibility, but, like all members of the genus Marasmius, they regain their pristine freshness with the return of rain. Sometimes, as if fatigued from the production of so much minute workmanship, the plants fail to produce caps, and the stems, too, are often abnormally grown together in a branching manner.

For culinary purposes this species is used as an addition to gravies. When garnishing veni-

Photograph by A. G. and B. Leeper

THE GEMMED PUFF-BALL (*Lycoperdon gemmatum*) FOUND EVERYWHERE

Though small, this "gem-studded" species is much sought by mushroom-eaters and may be discovered growing scattered or in tufts, usually on the ground. About one-half natural size.

son, it adds the appropriate touch of the wild woodlands.

This species grows on decaying wood (bark, roots, and stumps) and on old leaves in woods of maple, beech, etc.; time, June to September; distribution, temperate North America, Europe, and South Africa.

HEDGEHOG MUSHROOMS (Various species of Hydnum)

(*See Color Plate VI*)

Not infrequently the assiduous mushroom-hunter, "new to the game," finds specimens that do not tally at all with his conception of what a mushroom should be like. He has soon learned, of course, to recognize the gill tribes (see page 390), and the Boleti (see page 406), and perhaps the Clavarias (see page 412), but should he encounter a toadstool with "teeth," he will be nonplussed, until assured by his mycological mentor that there are such "animals," and that they go by the name of Hedgehog mushrooms.

They are not as frequent as the others, and therefore all the more of a surprise when met with. Some are conspicuously beautiful, and the story that the great Swedish mycologist, Elias Fries, was attracted to the study of the fungi on beholding in his youth a specimen of the snowy-white coral Hydnum may well be believed (see illustration, page 410).

The teeth, varying in size and color in different species, clothe the lower side of the fruit-bodies, which may be cap-like, as in agarics and boleti, branched, solidly formed into tuberous, fleshy masses, or spread out in a flat layer. No poisonous species are known, though many are tough, bitter, or malodorous, and thus naturally unattractive to the mycophagist.

Hydnum fennicum, the Finnish Hydnum (see Color Plate VI), is too bitter to be eaten, but its general aspect gives some idea of the appearance of the edible *H. imbricatum*. The latter species has a more umber-colored, less reddish cap, no blue discoloration in the flesh of the stem, a less bitterish taste, and coarser teeth. Deer are said to be fond of it.

THE CINNAMON CORTINARIUS (Cortinarius cinnamomeus). Edible

(*See Color Plate VII*)

Plants belonging to the bulky genus *Cortinarius* are very numerous in our forests during the autumn months; yet, except for a few well-characterized species, one and all are left severely alone by the average student of mushrooms; this not because of any fear from poisoning—the genus is a fairly safe one—but because of the difficulties attending their study.

It is easy enough to say that one has found a "Cort"—the term of endearment for members of this "offish" genus. To determine the plant

Photograph by A. G. and B. Leeper

THE GIANT PUFF-BALL (*Calvatia gigantea*)

The best-known of all puff-balls. A single specimen will suffice for the largest family. Diameter often fourteen inches and over.

As children, we have all squeezed the puff-ball to make it "puff," little realizing that in doing this we were liberating billions of spores, which—if everything went well with them—would produce in turn billions of puff-balls. But there is "many a slip" in the life of a puff-ball spore. Were this not so, the whole country at the proper season, would be paved with puff-balls.

A recent investigator, Professor Buller, computing the number of spores in a single good-sized specimen of the giant puff-ball, found that it contained about seven trillions (7,000,000,000,000); and yet this species is by no means as common as those who know its delicious flavor would like it to be. One is inclined to ask—as we do about the fate of pins—what becomes of them all? . . . The plant grows in grassy places, in August and September, sometimes in "fairy-rings." It is not very common, we regret to say.

To escape acceptance of the theory of the spontaneous generation of life, it has been suggested that extraordinarily minute organisms (bacteria, for example), or their spores, propelled alive through space, might be capable of carrying life to planets. When it is considered that the vitality of some spores remains unimpaired after prolonged exposure to liquid air and even liquid hydrogen, the suggestion seems plausible.

See also pages 392 and 402.

Photograph by A. G. and B. Leeper

THE CUP-SHAPED PUFF-BALL (*Calvatia cyathiformis*) COMMON IN FIELDS

The purplish-brown surface, cracked like an alligator's skin, is the distinguishing feature of this much-hunted species, which grows in pastures and in cultivated lands during August and September. Less than one-half natural size.

specifically, however, is a different problem, largely for the reason that it is essential to have more than one specimen, preferably a whole series, covering the development from extreme youth to full maturity.

If such a series is at one's disposal, important notes can be made—first, on the difference in the gill-color of young and old specimens; second, on the color of the cobweb-like veil, present in all true Cortinarii, and on the presence or absence of a secondary or universal veil; third, on the shape, color, and general surface characters (including degree of stickiness) of the plants.

The species included here and figured in its natural colors is sometimes found. The change in the color of the gills is shown, as is also the difference in the general aspect due to growth. The amateur would scarcely consider the two plants as belonging to one species. To complicate the situation further, this species has several varieties, one of which, with blood-red gills, is quite common.

Many species of *Cortinarius* exhibit beautiful coloration, the light lavender, blue, and violet-colored ones being noted in this respect. A few have bright red bands encircling their stems, as in the common *C. armillatus*.

THE CHANTRELLE (Cantharellus cibarius). Edible

(*See Color Plate VII*)

On special state occasions the golden Chantrelle graces the festive board, yet there is no reason in the world why it should not be on every man's table throughout the land and throughout the year. Abundant and easily recognized, any one may gather it in quantity and without fear of being poisoned.

Its natural habitat is in forests of spruce, pine, hemlock, beech, and other trees; commonly found growing in troops, from June to October. Long cooking over a slow fire, in a covered vessel, improves both flavor and consistency. The dressing may be simple or very elaborate. It dries readily.

Though a somewhat variable fungus, both as to shape and color, its characteristic, dull-edged, irregularly forked gills render identification easy.

It is a cosmopolitan species, but limited, as are most fleshy fungi, to the more temperate regions of the earth (see *Clitocybe illudens*, the False Chantrelle, Plate III).

THE PERENNIAL POLYSTICTUS (Polystictus perennis)

(*See Color Plate VII*)

When in the woods, "stalking" the edible fungi, the hunter, sensitive to the beautiful as well as the useful, cannot but stop to admire the little cinnamon-colored cups of various Polystictus species that stud his pathway. The present species is one of the commonest. A West African species, the magnificent *Polystictus sacer* is an object of religious worship with the natives. Let us hope that it is merely a worship at the shrine of beauty.

The genus *Polystictus* is a member of a large family, the Polyporaceæ. Some of the bracket- or hoof-shaped species of the polypores are familiar objects to the forest rambler. Unfortunately, they are only too familiar to the forester, many being very destructive to our trees. *Polyporus applanatus,* a common bracket fungus, deserves notice because of the use to which it is put by the collector who combines artistic proclivities with his mycologic ones. The under, or hymenial, surface of this fungus is almost white. Upon the slightest scratch, however, the white is removed and a dark line appears.

Provided with nothing more than a good fresh specimen of this fungus and a stylus in the form of a sharp-pointed branchlet, conveniently picked up at his feet, the artist-mycologist may proceed to sketch the landscape. If he has the ability of a Seymour Hayden or a Pennell, the result will compare favorably with a good etching. After the fungus is thoroughly dry, the picture is permanently fixed, and it may then be set up in the summer bungalow to recall a day pleasantly and profitably spent (see page 409 for illustration of *P. applanatus*).

THE EQUESTRIAN TRICHOLOMA (Tricholoma equestre). Edible

(*Lower left figure, Color Plate VII*)

The Tricholomata are attractive agarics. Clean, trim, often of elegant stature and beautiful coloring, they have become known in some countries under the attractive name of Knightly mushrooms. The time for their appearance is rather late in the autumn, when the air is a little chill and the forest foliage is beginning to glow with Titian's tints.

The present species, the Equestrian tricholoma, is one of the better-known examples of the genus. It is edible and therefore eagerly sought as soon as the weather is propitious. The taste is apt to be a little unpleasant in uncooked plants, but this is true of a number of edible species, notably of *Armillaria mellea* (Plate VI) and of *Lactarius piperatus,* a very large, coarse, white, "milk"-exuding species, common in woods. Conversely, some of the deadliest species of Amanita give no forewarning at all through the sense of taste.

The Equestrian tricholoma is found in pine woods; time, September to November; distribution, North America and Europe.

MORELS. (Edible)

(*See Color Plate VII*)

The Morel, or Sponge mushroom, belongs with the Ascomycetes, fungi quite distinct from those which bear gills, tubes, teeth, etc. Not only is there a marked departure in the external form, but the microscopic features, likewise, show a fundamental difference (see pages 420-421).

The normal time for Morels to appear is in spring, though they have been known to occur in autumn. After a gentle April shower, the fungus-hunter, betaking himself to the nearest apple or peach orchard, or to recently burnt-over wooded areas, searches for the light brownish, fawn-colored, or olive gray, pitted heads. If luck is with him he doesn't search long, for he soon finds enough of the coveted 'sponges" to give him his first taste of fresh mushrooms of the year.

For centuries the Morels have been favorites with the fungus-epicures. Indeed, so highly were they regarded by some European peoples that forests were burned down by them to obtain the substratum best suited to their development—a method of procedure that recalls Ho-ti's way of roasting pigs. In recent years efforts have been made by French investigators to grow the plants artificially.

Before proceeding to cook them, the plants should be washed to remove any earth that may be lodged in the pits of the cap. Then, cutting off as little of the stems as possible, the hollow interior must be thoroughly rinsed with hot water. Having further assured one's self that the plants are perfectly fresh, crisp, and clean, cooking can begin.

The methods of preparation for the table are various. Stuffed with veal, chicken, or anchovies, and garnished as elaborately as one pleases, they are especially delicious. But they lend themselves to any mode of cooking. Pennsylvania farmers, who know them as "Merkels," prefer them in a pot-pie.

Different species have been distinguished, but they are one and all edible when in first-class condition. Some, like *M. esculenta* (Color Plate VII), have a more or less rounded cap; others are conical in shape (*M. conica,* page 420), and one, which is said to be better than the rest, has a somewhat oblong, cylindrical, olive-gray cap, which is often a little curved (*M. deliciosa,* page 420). The species *M. semilibera* is shown in the illustration on page 421.

THE DELICIOUS, OR ORANGE-MILK, LACTAR (Lactarius deliciosus). Edible

(*See Color Plate VII*)

When injured, certain fungi have the peculiarity of exuding a colored, uncolored, or color-changing juice, called "milk," or latex. Among the larger gill-fungi that have this property are the members of the genus Lactarius.

Of the numerous edible species, the Orange-Milk Lactar—so named because of its orange-colored milk—is the most generally known, its reputation extending back to the old herbalists of the sixteenth century, and possibly to ancient Roman days, for a picture of this species, said to be the earliest representation of a fungus extant, was discovered on a wall in ill-fated Pompeii.

The following quotations will convey some idea of the esteem in which it was and is still held.

Sowerby says: "It is very luscious eating, full of rich gravy, with a little of the flavour of mussels." Sir James Smith pronounces it "the most delicious mushroom known." Other

Photograph by A. G. and B. Leeper

THE PEAR-SHAPED PUFF-BALL (*Lycoperdon piriforme*)

This small, edible species may be found on almost any rotting stump or log from July to late in the autumn. Natural size or a little under (see also picture on opposite page).

commendatory comments are: "Good, preserved in vinegar" (Richon and Rozé); "Most excellent" (Berkeley); "Fried with butter and salt, it has a taste like lamb" (De Seynes).

Dr. Peck, our own more recent authority, says, it is "one of our most valuable mushrooms, but scarcely equal to the best. Doubtless differences of opinion concerning it may be due in part to different methods in cooking."

With regard to tastes, it is always well to remember that they are individual; "otherwise moths would not eat cloth."

When eaten in the raw state, the Orange-Milk Lactar develops an acrid taste, and when old its bright-orange coloring changes to dull, grayish-greenish, unattractive hues. It is, therefore, inadvisable to eat uncooked or old specimens. Pickled in vinegar, however, it is very appetizing when served as a relish with cold meats.

This desirable species is found in moist, mossy woods of pine, tamarack, hemlock, etc.; time, July to October; distribution, North America and Europe.

PANÆOLUS Species
Poisonous

(*See Color Plate VIII*)

Every collector of edible species should learn to distinguish the Panæoli from *Agaricus campester* and the Coprini. Because of the dark, blackish coloring of their gills, they are very apt to get into a mess of either of these species, and when this happens the eater is almost sure to experience symptoms of poisoning. The differentiation of the species is an extremely difficult matter, but, generically, they are easily recognized by their slender stems, grayish or reddish-brown (sometimes hygrophanous), commonly bell-shaped or obtusely expanded caps, and—most important—by the black, or very nearly black, spores that are borne on non-deliquescent gills, generally in spot-like areas, causing the gills to appear mottled with black.

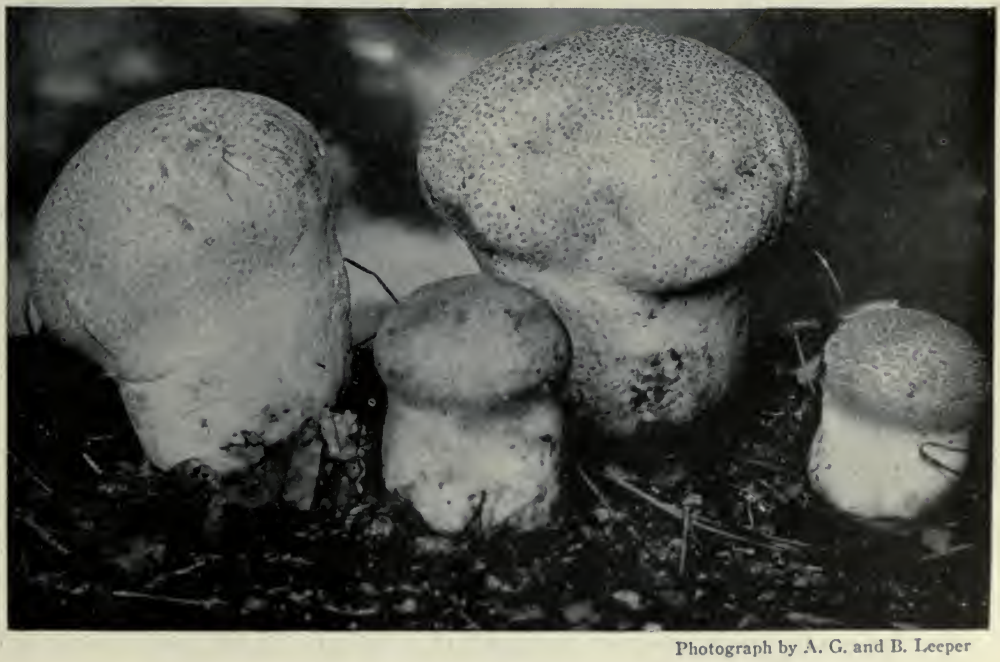
The symptoms from Panæolus poisoning appear very soon after the fungi have been eaten, sometimes within fifteen minutes. They seem to vary slightly, depending, presumably, upon the species and the amount consumed. The following have been recorded: failure of muscular coördination, giddiness, difficulty in standing, inability to walk, drowsiness, lack of control of the emotions (inordinate hilarity), incoherent or inappropriate speech. The sight is usually affected, causing the furniture to appear bent, pliable, and in motion; and there are visions of beautiful colors. Temporary paralysis of a limb may occur.

The effects of the intoxication are said to pass off within a few hours; still, it would seem that emetics ought to be administered without delay to prevent the complete absorption of the poisons.

Photograph by George Shiras, 3d

THE PEAR-SHAPED PUFF-BALL (*Lycoperdon piriforme*)

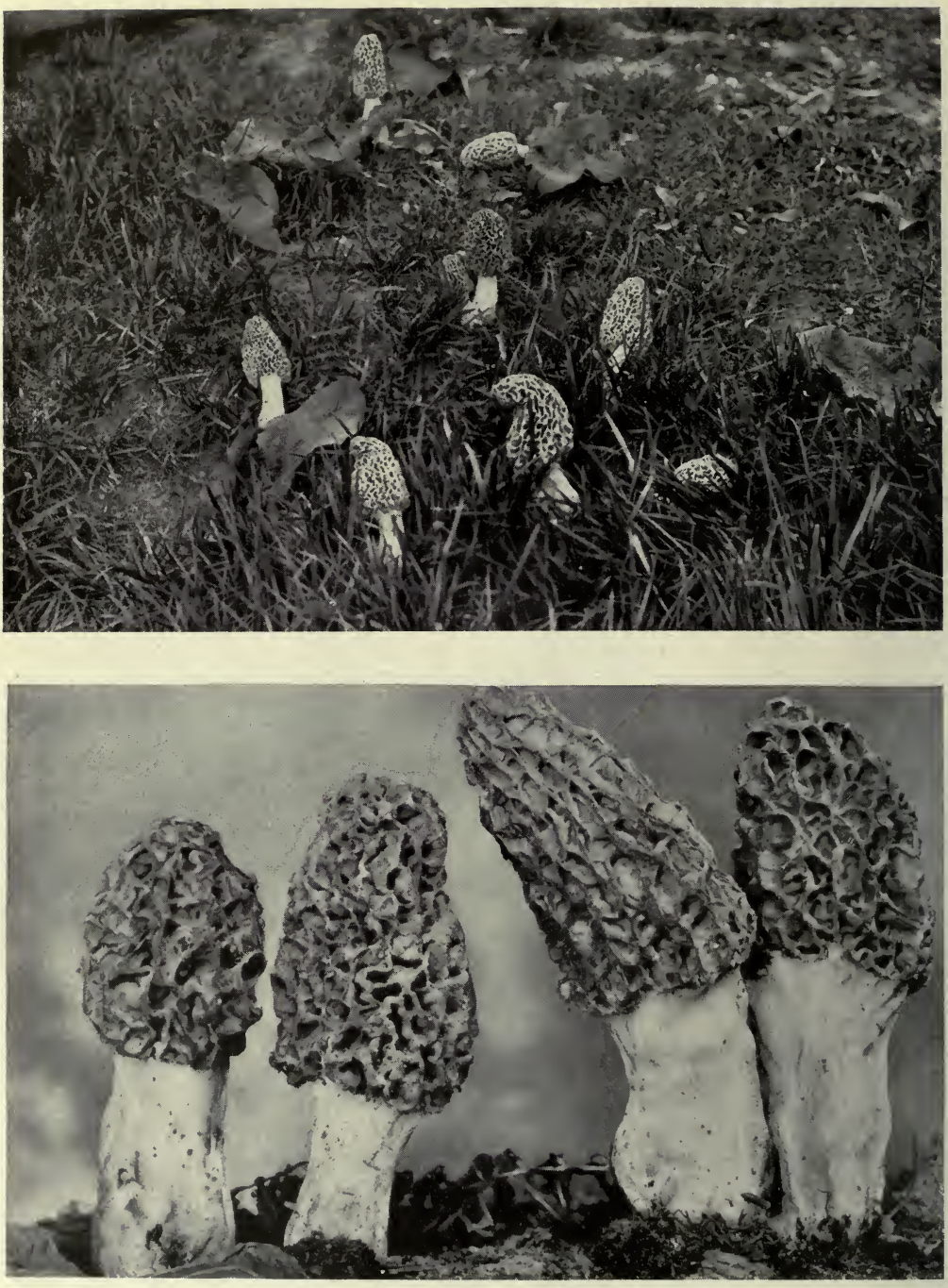
It is seen growing on and about the base of a tree (for another illustration of this species, see page 418). The plants are edible as long as the "flesh" is white.



Photograph by A. G. and B. Leeper

THE SKULL- OR BRAIN-SHAPED PUFF-BALL (*Calvatia craniiformis*)

One of the best, so long as the interior is white. Once the color changes, it is very bitter. Should be looked for in the autumn, in thickets by roadsides. About one-third natural size.



Photographs by A. G. and B. Leeper

MORELS: UPPER FIGURE, *Morchella deliciosa;* LOWER FIGURE, *Morchella conica.*
EDIBLE

After a gentle April shower the fungus-hunter will find these delectable mushroom morsels growing in old apple and peach orchards or in recently burnt-over wooded areas. The plants vary in height from two to six inches (see figure, lower right, Color Plate VII, and text, page 417).

THE BROWN GYROMITRA (*Gyromitra brunnea*). EDIBILITY DOUBTFUL

Since one species of Gyromitra is known to be poisonous, it is perhaps just as well to let them all alone. *G. brunnea* reaches a height of seven inches.

Photographs by A. G. and B. Leeper

THE HALF-FREE MORCHELLA (*Morchella semi-libera*). EDIBLE

This morel is small and not as sapid as the larger species. The term "half-free" refers to the attachment of the cap to the stem. The sectional view on the extreme right shows that the cap is only half-attached, or half-free. (For other Morels, see page 420 and figure in lower right, Color Plate, VII.)

LAWN MUSHROOMS (including **Naucoria semiorbicularis**, edibility doubtful, and **Pholiota præcox**, edible)

(*See Color Plate VIII*)

Some one has said that he who wishes to explore the world should begin at his own doorstep. Addressed to the incipient mushroom collector, this maxim imparts wholesome advice, for without stirring far from home—yes, within eyeshot of his front door—he can collect enough species to make a respectable list, and not a few that will give him something more substantial in the way of a delicious snack of mushrooms; also, he is likely to encounter some that are poisonous.

Among the species to be looked for on lawns and other grassy places are:

Naucoria semiorbicularis (see Color Plate VIII, the small cluster and single figure in upper right), is very common on lawns. The caps are somewhat sticky in wet weather and the stems have a characteristic, easily removed, pale pith within. Edibility doubtful.

Pholiota præcox, the early Pholiota (see Color Plate VIII, showing two plants, young and old, lower right). This is another common, edible, mushroom of our lawns. Appears early in the spring. The young plant shows the ring before it becomes detached from the edge of the cap; the older one shows this tissue hanging down and covered with a dense deposit of the rusty-brown spores. The cap of the early Pholiota varies in color from darkish ocher and brownish to a creamy white more or less pale. Occasionally the surface is finely cracked into little areas. The variety shown here grows in thin woods. In young plants the gills are colored a beautiful warm gray.

THE GLISTENING COPRINUS (Coprinus micaceus)

(*See Color Plate VIII*)

The Glistening Coprinus (*Coprinus micaceus*), illustrated on page 404, is familiar to every one. It is one of the first mushrooms to respond to the showers of early spring. Almost any stump will yield hundreds of specimens. To save trouble, the abundant crop should be "harvested" with a pair of shears. When simmered down they make an excellent ketchup.

The minute glistening particles on the cap and the fine, long grooves on the margin of the same at once mark the species.

THE IMPERIAL AGARIC, OR CÆSAR'S MUSHROOM (Amanita cæsarea). Edible

(*See Color Plate IX*)

This brilliantly colored, stately agaric is the famed "boletus" served at the feasts of the emperors of ancient Rome, and lauded in prose and verse by the writers of that period. So highly was it esteemed by epicures that they prepared and cooked the plants themselves, performing these operations with utensils of amber and gold. Special vessels, "boletaria," were used in cooking the boleti, though in some households they doubtless got mixed occasionally with other pots and pans. Martial, in his "Epigrams," lets one that was so treated bewail its fate:

> "Although boleti have given me
> so noble a name, I am now
> used, I am ashamed to say, for
> Brussels sprouts."

From Juvenal we learn that the preparing of boleti by the young patricians themselves was regarded as a sign of the mollycoddle, for he writes:

> "Nor will that youth allow any
> relative to hope better of him
> who has learnt to peel truffles
> and to pickle boleti."

Cæsar's mushroom grows with us today, its distribution being limited, however, to the States east of Ohio. It is especially abundant in the South, and occurs sparingly as far north as Nova Scotia. If there is much showery weather, it may be looked for in open coniferous and deciduous woods from July to October. Occasionally it forms huge "fairy-rings."

Except for the very real danger of confounding it with the deadly *Amanita muscaria* (Color Plates II and XV, and chart, page 389), there is no reason why it should not again become a favorite with those who, like the old Romans, are fond of rare delicacies. But those who wish to try it should postpone the pleasure until they are thoroughly familiar with a considerable number of Amanitas, as an error in observation may mean death, preceded by horrible agonies (see the symptoms of poisoning by *Amanita muscaria*, on page 403).

No difficulty will be experienced in avoiding the citron-colored variety of the deadly *Amanita phalloides* (see figure at extreme right of Plate V). The cap in that variety is never orange, the gills and stem are never clear yellow, and the volva is composed of short, thick segments surrounding the upper part of the large, globular base of the stem.

[For Color Plate X, see the Deadly Amanita, page 409).

THE SOOTY LACTAR (Lactarius ligniotus). Edibility doubtful

(*See Color Plate XI*)

To the city dweller, who through force of circumstances is allowed a limited number of cubic feet of air in which he must "live, move, and have his being," it must be tantalizing to read that this attractive lactar leads its life in the cool, mossy depths of the vast fir forests. In the hot months of July and August, the time of its occurrence, it is well to have ready this excuse for an outing: "I am going in quest of the sooty lactar."

THE FIELD, OR HORSE MUSHROOM (*AGARICUS ARVENSIS*): Edible
The large plant and sectional view. Somewhat reduced in size.
The strong, sweetish odor given off by this agaric is objectionable to some.
THE COMMON MEADOW-MUSHROOM (*AGARICUS CAMPESTER*): Edible
Figure at lower right. Under natural size.
When the average person says "mushroom," it is this species that is meant.

THE FLY-MUSHROOM (*AMANITA MUSCARIA*): Deadly poisonous
Mature specimen. Somewhat under natural size.
This species and *Amanita phalloides* (see Nos. X and XVI) are the common causes of serious mushroom-poisoning (for figures of young plants, see No. XV).

JACK-O'-LANTERN (*CLITOCYBE ILLUDENS*): Poisonous
About four-fifths natural size.

A conspicuous object by daylight, this Clitocybe is also visible in the profoundest darkness, the phosphorescent light which it emits betraying its presence. Should not be confounded with the edible Chantrelle (see No. VII, figure at upper right).

THE EDIBLE BOLETUS, THE "CÈPE" OF COMMERCE (*BOLETUS EDULIS*)
Somewhat under natural size.
The mushroom connoisseur should cultivate the acquaintance of this most excellent species.

Figure on left: THE HANDSOME VOLVARIA (*VOLVARIA SPECIOSA*). Edibility doubtful. In the genus Volvaria there is a volva, but no ring; the spores and gills are pink or reddish, and the latter are free from the stem. Middle figure: CLAVARIA FUSIFORMIS. Like tongues of flame, this beautiful Clavaria shoots from the mossy beds of cool, moist woodlands. It is edible. Figure on right: THE LEMON-YELLOW AMANITA (*AMANITA CITRINA*). Deadly poisonous. Some mycologists consider this a variety of *Amanita phalloides* (see Nos. X and XVI).

Upper figure: THE HONEY MUSHROOM, OR OAK FUNGUS (*ARMILLARIA MELLEA*): Edible. This common agaric is the bane of the orchardist (see also photographs and text). Figure in the middle on the left: THE GARLIC MUSHROOM (*MARASMIUS SCORODONIUS*): Edible. The odor of garlic is so pronounced in this little species that the "nose knows" it before the eye sees it. Figure in the middle on the right: THE LITTLE WHEEL MUSHROOM (*MARASMIUS ROTULA*): Edible. When garnishing venison, this dainty Marasmius adds the appropriate touch of the wild woodlands. Lower figure: THE FINNISH HYDNUM (*HYDNUM FENNICUM*). This species is too bitter to be eaten, but the nearly related *H. imbricatum* is a great favorite with European peoples. All figures about two-thirds natural size.

Upper left: THE CINNAMON CORTINARIUS (*CORTINARIUS CINNAMOMEUS*). The Cinnamon Cortinarius is not highly recommended as an edible species. Upper right: THE CHANTRELLE (*CANTHARELLUS CIBARIUS*): Edible. (See *Clitocybe illudens*, No. iii.) Upper middle: THE PERENNIAL POLYSTICTUS (*POLYSTICTUS PERENNIS*). "Stalking" fungi, the hunter, sensitive to beauty as well as usefulness, must stop to admire this species. Lower left: THE EQUESTRIAN TRICHOLOMA (*TRICHOLOMA EQUESTRE*): Edible. They appear in our forests late in autumn. Lower right: THE MOREL (*MORCHELLA ESCULENTA*): Edible. Esteemed by epicures. Lower middle: THE DELICIOUS, OR ORANGE-MILK LACTAR (*LACTARIUS DELICIOSUS*): Edible. "It is very luscious eating, full of rich gravy, with a little of the flavour of mussels." All figures about two-thirds natural size.

Upper left: A species of PANÆOLUS (poisonous). Upper right: NAUCORIA SEMI-ORBICULARIS (edible qualities doubtful). Lower left: THE GLISTENING COPRINUS (*COPRINUS MICACEUS*): Edible. Lower right: THE EARLY PHOLIOTA (*PHOLIOTA PRÆCOX*): Edible. All figures about two-thirds natural size.

CÆSAR'S MUSHROOM (*AMANITA CÆSAREA*): Edible
Somewhat under natural size.

History tells us that a dish of this mushroom, "seasoned" with mineral poisons, constituted the last meal of the Roman Emperor, Claudius Cæsar. His wife, Agrippina, did the seasoning.

THE DESTROYING ANGEL (*AMANITA PHALLOIDES* VAR. *VIROSA*).
Deadly poisonous. About four-fifths natural size.
One of the worst of the man-killing mushrooms. Note the "death-cup" at the base of the stem (see No. XVI ; and No. V, figure on right).

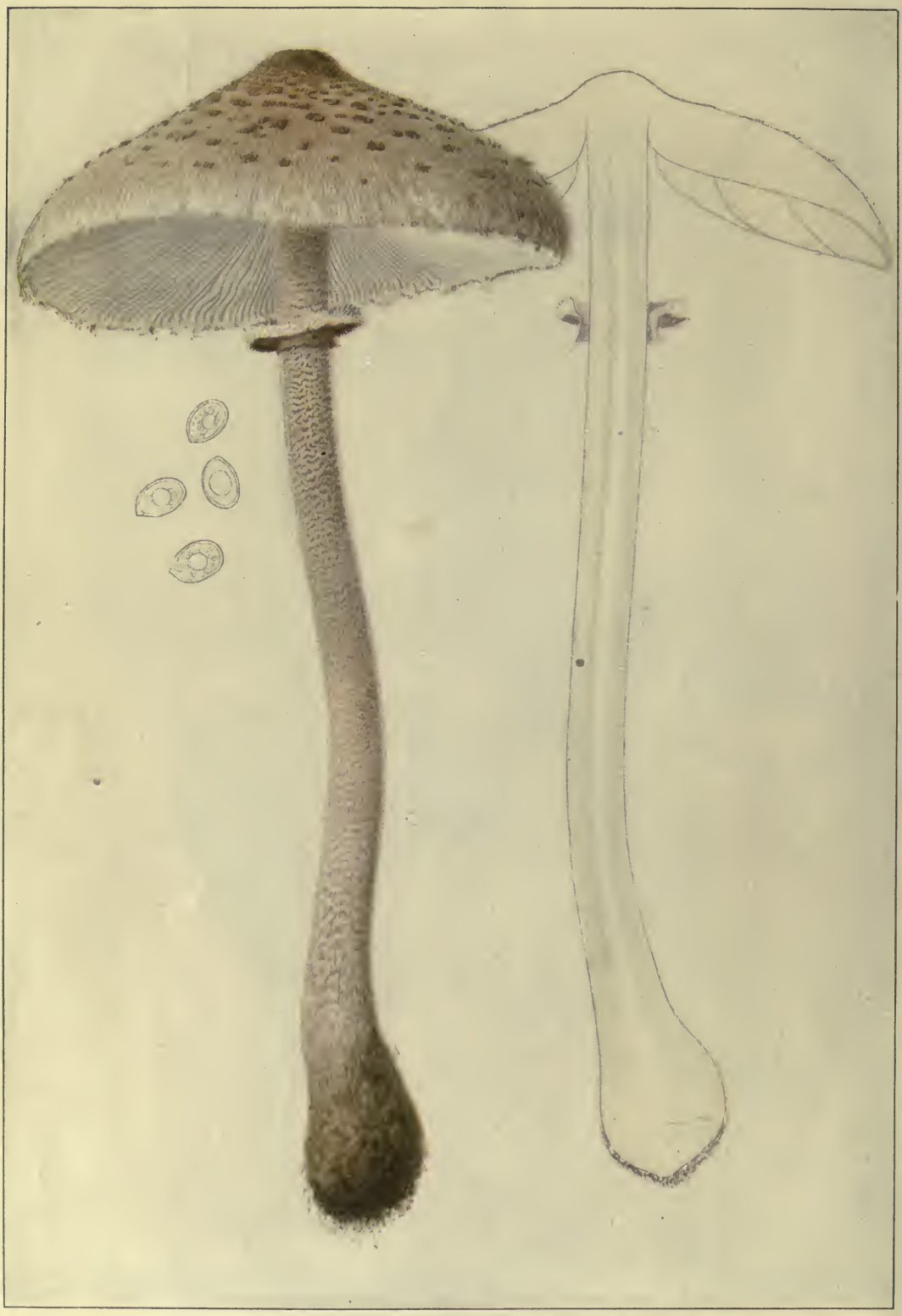
THE SOOTY LACTAR (*LACTARIUS LIGNIOTUS*): Edibility doubtful
Somewhat under natural size.
The play of light on the velvety coat of this species attracts the artist who delights in texture rendering.

THE SHAGGY-MANE (*COPRINUS COMATUS*): Edible
About four-fifths natural size.

The oval caps of the Shaggy-mane, poised on end, like Columbus' egg, are familiar objects on lawns and other rich grounds. Note the "cord" suspended in the hollow of the stem.

THE GYPSY (*PHOLIOTA CAPERATA*): Edible
Somewhat under natural size.

Though commonly known as *Pholiota caperata*, this species has been so much thrown about, from genus to genus, that, like the gypsies, it may be said to be quite homeless; whether this is the reason for its common name has not been ascertained.



THE PARASOL MUSHROOM (*LEPIOTA PROCERA*): Edible
About four-fifths natural size.

The Parasol is a prime favorite with mushroom eaters—so much so, that one shares a mess of it only with one's best friend.

THE FLY-MUSHROOM (*AMANITA MUSCARIA*): Deadly poisonous
Young specimens. Natural size.
A mature specimen is shown in No. II.

THE DEADLY AMANITA (*AMANITA PHALLOIDES*)
Somewhat under natural size.

The avoidance of *Amanita Phalloides* and *A. muscaria* (see No. II) should be the first concern of the mycophagist.

Fully to appreciate its beauty, one should see the plant in Nature's own setting, as it reposes upon a fresh, green, mossy bank at the foot of a great fir, with the crystalline drops of the morning dew still studding the smooth, velvety coat, with birds singing overhead and squirrels scolding us for calling at such an unseasonable hour in the morning.

THE INK MUSHROOMS, OR INK-CAPS (Species of Coprinus)

(See Color Plate XII)

The Ink-caps need no formal introduction, for every one has seen the "Shaggy-mane" (Coprinus comatus) (Color Plate XII) standing on end, like Columbus' egg, in lawns and other grassy places. If one returns later one may behold

"Their mass rotted off them flake by flake,
Till the thick stalk stuck like a murderer's stake,
Where rags of loose flesh yet tremble on high,
Infecting the winds that wander by."

Shelley's lurid lines allude to the liquefaction of the caps, a feature which at once distinguishes the Coprini from other black-spored agarics. It is, however, not a process of putrefaction, as the poet would have us believe, but a natural physiological one.

Shaggy-manes are rapid growers, and, coming up in dense masses, as they sometimes do, they are capable of producing considerable pressure upon objects that obstruct their growth. The writer knows of a case where a thick, newly laid concrete walk was broken up for some distance by a colony of these large, yet tender, mushrooms.

The black "ink" into which the caps of Coprini dissolve can be employed for writing. Indeed, in France, during the war, it was proposed that Coprinus ink be used in place of the regular article, which was becoming more and more expensive. But even in peace times the mushroom ink would prove valuable, as it could be used in legal documents or in any important papers that are apt to be fraudulently imitated.

Ink from some especially rare species with well-marked spore characters would be well-nigh impossible to imitate, as the microscope would divulge instantly and beyond peradventure whether the fluid was obtained from the rare Coprinus. To make matters still more difficult for forgers, characteristic, easily recognized spores from other rare species—not necessarily black-spored nor from agarics—could be added to this forgery-proof and indelible writing fluid. Small amounts of gum arabic and essence of cloves in the ink will give adhesiveness and a pleasant odor.

The edibility of the Coprini (see also Glistening Coprinus, Color Plate VIII) is unquestioned by most writers, but care should be exercised that only fresh specimens are utilized, and that they be cooked without delay, as deliquescence sets in very soon.

THE WRINKLED PHOLIOTA, OR THE GYPSY (Pholiota caperata). Edible

(See Color Plate XIII)

The ocher-colored cap with whitish, fleecy, silky fibrils scattered over the central portion, the brownish-yellow, longitudinally wrinkled, saw-edged gills, together with the slightly volvate, whitish stem that bears a double-edged ring about midway of its length, make the Wrinkled Pholiota one of the most easily recognized species.

It is quite common, growing scattered or gregariously in woods (especially of pine), in mossy swamps, and in open places, from July to October. Its edibility is unquestioned.

THE PARASOL MUSHROOM (Lepiota procera). Edible

(See Color Plate XIV)

Happy is the mushroom-hunter if, after a foray, his "bag" includes many Parasols, for it is not often that he encounters this most desirable species in sufficient quantity to satisfy his appetite.

Though pretty effectually camouflaged in coloring, its great height makes it a conspicuous object. A giant specimen once reported to the writer measured seven inches across the cap and twenty-two inches in stem length. This monster mushroom was found growing among low blueberry bushes—a fact that would seem to indicate an acid food requirement for the species.

Successful efforts have been made in France to cultivate the plant from its spores, and Professor Duggar, in this country, has demonstrated that it responds vigorously to the tissue-culture method. It is to be hoped that some of our pure-culture spawn-producers will take up the problem and produce the spawn on a commercial scale, so that it may be bought by growers. *Lepiota rhacodes,* a near relative and just as desirable, might prove even more responsive to culture methods.

In the opinion of gourmets, the Parasol mushroom is at its best when quickly broiled over the live embers of a camp-fire, with just enough basting with hot butter to keep it from burning. Then, properly seasoned and served with a partridge or two, the gustatory apparatus experiences sensations not readily forgotten.

Such an eventuality as an oversupply almost never happens, but if by rare chance more specimens should be collected than can be at once disposed of, it is well to remember that dry they are even better than fresh.

The habitat of the Parasol mushroom is meadows, pastures, and open, thin woods; time, summer and early autumn; distribution, cosmopolitan.

[For Color Plate XV, see the Fly Mushroom, page 403.]

[For Color Plate XVI, see the Deadly Amanita, page 409.]

HURDLE RACING IN CANOES

A Thrilling and Spectacular Sport Among the Maoris of New Zealand

By Walter Burke

THE title of this article sounds like a fairy tale; yet hurdle racing in canoes is a highly developed sport among the New Zealand Maoris.

Two or three things are necessary for the sport: First, the canoes must be dug-outs. The dainty canoes so popular on the American lakes and rivers and the beautiful birch-barks of the Canadian voyageurs would be too fragile, crumpling up like matchwood at the first hurdle.

A swift-running river is also desirable, in order that the crews may have the help of the increased speed given by the current to carry the centers of the canoes over the hurdle. This is an important consideration, as can be seen from the photographs. And the contestants must be good swimmers. As every Maori—man, woman, or child—is, there is no risk of drowning, even in the roughest water.

One sees the game at its very best at Ngaruawahia, a village in the North Island, a little south of Auckland, on the seventeenth of March in any year—St. Patrick's Day.

At this point the Waikato, one of the finest rivers in the Dominion, widens out and sweeps round a bend to meet another branch. The river carries a great volume of water, draining an enormous watershed in the center of the island, including Lake Taupo, into which some thirty streams discharge. The Waikato plunges over the Huka Falls, a miniature Niagara, below which are the Aratiatia Rapids, quite impassable for any boat. It is at this point that it is proposed to generate sufficient electricity to run the railway system of the North Island.

Prior to *the* day, the Maoris collect from all the adjacent territory, bringing with them their prize canoes, each dug out of the trunk of a tree. Some of these boats are large enough to carry a crew of from thirty to more than forty paddlers. These are not for hurdling, however!

The secret—more or less—trials proceed; training is keen and hard; the betting heavy, for most Maoris are well-to-do and are keen sportsmen, willing to gamble on anything, from "fly loo" to a horse-race! The excitement progresses till the eventful day, when special trains bring immense numbers of Maoris and Pakehas (white people) from far and near.

The program includes many and varied events, but the great attraction is the hurdle racing, just as the steeplechase attracts the eager crowd at a turf event. Of course, in saying this, I am not belittling the excitement over the big canoe races. There is not the fun in these, however, as there are no accidents, while the hurdle racing is one continuous series of them—a spill at practically each hurdle, of which there are usually three or four.

Unless the bow of the canoe is well out of the water, it cannot take the hurdle, which is from twelve to eighteen inches above the surface. The object is to get up such speed that when the bow slides on to the hurdle the smooth and well-greased bottom will continue to glide till past the center of gravity, when the members of the crew run forward and their weight causes the bow to go down with a "flop" and the stern slides off. The bow usually dips under and partly fills the canoe with water, which is removed by rocking or is splashed out with the aid of the flat of the paddle.

This is the program when all goes well! And it will probably happen when one canoe can shoot away from the others and negotiate the first hurdle alone. But usually about four or five canoes come down almost simultaneously, the crews yelling like fiends, and there is a thrilling mix up, from which the brainiest crew, with the best of luck, gets out of the ruck and away.